

NEW SYNONYMY AND NEW SPECIES OF AMERICAN BARK BEETLES (COLEOPTERA: SCOLYTIDAE), PART II²

Stephen L. Wood²

ABSTRACT.— New synonymy is proposed as follows: *Pityophthorus* Eichhoff (= *Gnathophorus* Schedl, *Gnathophthorus* Wood), *Araptus confinis* (Blandford) (= *Neopityophthorus glabricollis* Schedl), *A. eruditus* (Schedl) (= *Neodryocoetes buscki* Blackman), *A. hymenaeae* (Eggers) (= *Neodryocoetes humilis* Blackman), *A. schedli* (Blackman) (= *Neodryocoetes lenis* Blackman), *A. tenellus* (Schedl) (= *Ctenyophthorus mexicanus* Schedl, *Neodryocoetes granulatus* Schedl, *Araptus cuspidus* Wood), *Coccotrypes carpophagus* (Hornung) (= *Coccotrypes liberiensis* Hopkins, *Coccotrypes punctatulus* Eggers), *C. dactyliperda* (Fabricius) (= *Coccotrypes bassivorus* Hopkins), *C. robustus* Eichhoff (= *Coccotrypes cylindricus* Schedl), *Cryptocarenum heveae* (Hagedorn) (= *Cryptocarenum caraibicus* Eggers), *Hypothenemus setosus* (Eichhoff) (= *Stephanoderes congonus* Hagedorn), *Microcorthylus minutus* Schedl (= *Microcorthylus minutissimus* Schedl), *Pseudopityophthorus limbatus* Eggers (= *Pseudopityophthorus micans* Wood), *Xyleborus obliquus* (LeConte) (= *Xyleborus gilvipes* Blandford, *X. brasiliensis* Eggers, *illepidus* Schedl). *Hypothenemus javanus* Eggers is a valid species. The genus *Dacnophthorus*, type-species *Gnathophthorus clematus* Wood, is described as new to science. The following species are described as new to science: *Araptus consobrinus*, *A. micaceus*, *Pityophthorus explicitus*, and *P. inceptus* (Mexico). *P. costatus* and *P. mendosus* (Costa Rica), *P. degener* and *P. timidulus* (Panama), *P. amicus* (Mexico, Costa Rica), and *P. dissolutus* (Costa Rica, Panama), *Xyleborus californicus* (California), *X. incultus*, *X. molestulus* (Panama), and *tristiculus* (Brazil).

On the following pages several newly discovered cases of synonymy, one new genus, and 14 species new to science are presented for American Scolytidae. The specific synonymy is presented alphabetically for convenience of reference. The species new to science represent the genera *Araptus* (2), *Pityophthorus* (8), and *Xyleborus* (4). They are from the following countries: United States (1), Mexico (4), Costa Rica (2), Panama (4), Brazil (1), Mexico and Costa Rica (1), Costa Rica and Panama (1).

NEW SYNONYMY

Pityophthorus Eichhoff

Pityophthorus Eichhoff, 1864, Berliner Ent. Zeit. 8:39 (Type-species: *Bostrichus lichtensteini* Ratzeburg, subsequent designation by Hopkins, 1914, Proc. U.S. Nat. Mus. 48:127)

Gnathophorus Schedl, 1935 (nec Kirby, 1837), Rev. de Ent. 5:342 (Type-species: *Gnathophorus sparsipilosus* Schedl, monobasic). *New synonymy*

Gnathophthorus Wood, 1962, Great Basin Nat. 22:76 (Replacement name for *Gnathophorus*). *New synonymy*

The holotype of *Gnathophorus sparsipilosus* Schedl was examined and compared directly to a series of this species in my collection. It fits well within the limits of the genus *Pityophthorus* anatom-

ically as well as biologically. For this reason the names *Gnathophorus* and its replacement, *Gnathophthorus*, must be placed in synonymy as indicated above. The five species subsequently assigned to this genus must be transferred to another genus that is described below.

Araptus confinis (Blandford)

Pityophthorus confinis Blandford, 1904, Biol. Centr. Amer. Coleopt. 4(6):241 (Lectotype, male; Jalapa, Veracruz, Mexico; British Mus. Nat. Hist., present designation)

Neopityophthorus glabricollis Schedl, 1938, Archiv Naturgesch. 7(2):181 (Holotype, male; Tepic, Chiapas, Mexico; Schedl Coll.). *New synonymy*

The first syntype in the type series of *Pityophthorus confinis* Blandford is here designated as the lectotype of that species. This lectotype was compared directly to my males from Guatemala City, Guatemala, and was found to be identical in all respects. My series was later compared directly to the male holotype of *Neopityophthorus glabricollis* Schedl. Except for the loss of declivial and frontal setae, an apparent result of abrasion on the Schedl type, these specimens are also identical. As indicated above, the junior name must be placed in synonymy. The lectotype of *confinis* is labeled "Type" and has been considered as the type for many years.

¹Part of this research was sponsored by the National Science Foundation.

²Department of Zoology, Brigham Young University, Provo, Utah 84602. Scolytidae contribution No. 61

Araptus eruditus (Schedl)

Neopityophthorus eruditus Schedl. 1938, Archiv Naturgesch., n. f., 7(2):182 (Holotype, female; Mexico; Schedl Coll.)

Neodryocoetes buscki Blackman, 1942, Proc. U.S. Nat. Mus. 92:192 (Holotype, female; Cabima, Panama; U.S. Nat. Mus.). *New synonymy*

The female holotype of *Neopityophthorus eruditus* Schedl and the female holotype of *Neodryocoetes buscki* Blackman were compared directly to my series. All represent the same species. The last visible abdominal sternum is armed by a subtuberculate callus which aids in the identification of this species.

Araptus hymenaeae (Eggers)

Neodryocoetes hymenaeae Eggers, 1933, Mem. Trav. Lab. d'Ent. Mus. Nat. d'Hist. Nat., Paris 1(1):9 (Holotype, female; Gourdonville, French Guiana; Paris Mus.)

Neodryocoetes humilis Blackman, 1942, Proc. U.S. Nat. Mus. 92:188 (Holotype, female; Bonito, Pernambuco, Brazil; U.S. Nat. Mus.) *New synonymy*

The variable frons of this species has led to the description of several synonyms. Following a study of the holotype and six cotypes of *Neodryocoetes hymenaeae* Eggers, the female holotype of *Neodryocoetes humilis* Blackman, and 76 other specimens, it was concluded that only one species was represented and that Blackman's name must be placed in synonymy.

Araptus schedli (Blackman)

Neodryocoetes schedli Blackman, 1942, Proc. U.S. Nat. Mus. 92:195 (Holotype, male; Tampico, Mexico; U.S. Nat. Mus.)

Neodryocoetes lenis Blackman, 1942, Proc. U.S. Nat. Mus. 92:198 (Holotype, male; Cordoba, Veracruz, Mexico; U.S. Nat. Mus.). *New synonymy*

The male holotypes of *Neodryocoetes schedli* Blackman and *Neodryocoetes lenis* Blackman were compared directly to one another and to several specimens intercepted at New York in seeds of Mexican origin. I am unable to detect any differences among these specimens that might justify the continued recognition of two names.

Araptus tenellus (Schedl)

Neodryocoetes tenellus Schedl, 1951, Dusenja 2: 109 (Holotype, male; Chiapas, Mexico; Schedl Coll.)

Ctenyophthorus mexicanus Schedl, 1963, Ent. Arb. Mus. Frey 14:162 (Holotype, female; Trampaluz, Escarcaga, Campeche, Mexico; Schedl Coll.). *New synonymy*

Neodryocoetes granulatus Schedl, 1964, Reichenbachia 3:311 (Replacement name for *Ctenyophthorus mexicanus* Schedl). *New synonymy*

Araptus cuspidus Wood, 1974, Brigham Young Univ. Sci. Bull., Biol. Ser. 19 (1):46 (Holotype, female; 8 km E San Blas, Nayarit, Mexico; Wood Coll.). *New synonymy*

The holotype of *Neodryocoetes tenellus* Schedl and the allotype of *Araptus cuspidus* Wood were compared directly to one another. Except for minor differences in the convexity of the frons, they are identical. The peculiar abdominal sternum 5 was not mentioned by Schedl. The Schedl holotype of *Ctenyophthorus mexicanus* is a female, not a male as stated in the original description. It was compared directly to the holotype of *cuspidus* and was found to be identical. The two junior names and the replacement name, *Neodryocoetes granulatus* Schedl, must be placed in synonymy as indicated above.

Coccotrypes carpophagus (Hornung)

Bostrichus carpophagus Hornung, 1842, Stettiner Ent. Zeit. 3:116 (Syntypes; intercepted in Germany from "Betelnüssen" of "Ostindien" origin)

Coccotrypes liberiensis Hopkins, 1915, U.S. Dept. Agric. Rept. 99:47 (Holotype, female; Mount Coffee, Liberia; U.S. Nat. Mus.). *New synonymy*

Coccotrypes punctatulus Eggers, 1951, Ent. Blätt. 45:46:151 (Holotype, female; Insel St. Thomas, Virgin Islands; deposited in Eggers Coll., apparently on loan to Schedl). *New synonymy*

The holotypes of *Coccotrypes liberiensis* Hopkins and *C. punctatulus* Eggers and the syntypes of *Bostrichus carpophagus* Hornung were all examined and compared directly to my series of this species. Only one species is represented by the three names.

Coccotrypes dactyliperda (Fabricius)

Bostrichus dactyliperda Fabricius, 1801, Systema Eleutheratorum 2:387 (Syntypes; in date pits intercepted in Europe; Copenhagen and Berlin museums)

Coccotrypes bassiaevorus Hopkins, 1915, U.S. Dept. Agric. Rept. 99:47 (Holotype, female; Washington, D.C.; U.S. Nat. Mus.). *New synonymy*

Several female specimens of *Coccotrypes dactyliperda* (Fabricius) that were

compared by Eggers to the Fabricius syntypes were compared directly to the female holotype of *C. bassiavorus* Hopkins. Since they are identical in all respects, Hopkins's name must be placed in synonymy.

Coccotrypes robustus Eichhoff

Coccotrypes robustus Eichhoff, 1878, Mém. Soc. Roy. Sci. Liège (2)8:313 (Syntypes?; Cuba; presumably lost with Hamburg Mus.)

Coccotrypes cylindricus Schedl, 1949, Tijdschr. Ent. 91:116 (Holotype, female; Crucos. Cuba; Schedl Coll.). *New synonymy*

A female of *Coccotrypes robustus* Eichhoff that was compared by Hopkins to a syntype and the holotype of *C. cylindricus* Schedl were compared to my series of this species. Since all represent the same distinctive species, Schedl's name must be placed in synonymy.

Cryptocarenus heveae (Hagedorn)

Stephanoderes heveae Hagedorn, 1912, Rev. Zool. Afr. 1:338 (Syntypes, female; Eala, Congo; Tervuren Mus.)

Cryptocarenus caraibicus Eggers, 1937, Rev. de Ent. 7:82 (Holotype, female; Guadeloupe; U.S. Nat. Mus.). *New synonymy*

The four female syntypes of *Stephanoderes heveae* Hagedorn and the female holotype of *Cryptocarenus caraibicus* Eggers were compared to my material. All of these specimens represent the same species.

Schedl (1975, Ent. Blätt. 71:43) treated *C. lepidus* Wood as a synonym of *C. caraibicus*. These species are easily confused but quite distinct.

Hypothenemus setosus (Eichhoff)

Hypoborus (?) *setosus* Eichhoff, 1867, Berliner Ent. Zeitschr. 11:391 (Syntypes, Guadeloupe; one syntype in U.S. Nat. Mus., others lost with Hamburg Mus.)

Stephanoderes congonus Hagedorn, 1912, Rev. Zool. Afr. 1:337 (Lectotype, female; Eala, Congo; Tervuren Mus., present designation). *New synonymy*

Stephanoderes congonus Hagedorn was based on a syntypic series. Four of those syntypes are in the Musée Royal de l'Afrique Central, Tervuren, labeled as one "Holotypus" and three "Paratypus." These type designations, however, have not been mentioned in print and are con-

sidered invalid. The "Holotypus" is severely damaged but recognizable. All four specimens bear identical data labels: "Musée du Congo Belge; Eala; Rakusu (li?? 1140 M, 1911); D. Hevea brasiliensis." Because the first specimen is severely damaged, I designate the third specimen as the lectotype.

The above lectotype was compared to several of my series of *setosus* (Eichhoff) that previously had been compared directly to the only known syntype of *setosus*. Only one species is represented by this material. It is a species distinct from *javanus* (Eggers), as noted below. Other synonyms of *setosus* include *Stephanoderes obscurus* Eichhoff (nec Ferrari) and *S. depressus* Eichhoff.

Hypothenemus javanus Eggers, new status

Stephanoderes javanus Eggers, 1908, Ent. Blätt. 4:215 (Lectotype, female; Java; U.S. Nat. Mus., designated by Anderson and Anderson, 1971, Smithsonian Contrib. Zool. 94:16)

This species was placed in synonymy under *setosus* (Eichhoff) by Schedl (1962, Ent. Blätt. 58:204). Using the lectotype of *javanus* as a point of reference, I (Wood, 1972, Great Basin Nat. 32:51) added several additional synonyms. A re-examination of the types of *javanus*, *setosus*, and all synonyms, and 172 other specimens assigned to *setosus*, clearly indicates the existence of two easily distinguished species. *Hypothenemus javanus* (= *Stephanoderes obesus* Hopkins, *S. philippinensis* Hopkins, *S. bananensis* Eggers, *S. kalshoveni* Schedl, *S. subagnatus* Eggers) has a stouter body form (2.2 times as long as wide), only 12-18 coarse asperities on the anterior slope of the pronotum, 2-4 denticles on the anterior margin of the pronotum, and several minor differences in details of sculpture. It occurs in Indonesia, Philippines, Florida, Cuba, Jalisco (Mexico), Congo, Ghana, and the Camerouns. *Hypothenemus setosus* has the body 2.4 times as long as wide, more than 25 pronotal asperities, 6-8 denticles on the anterior margin of the pronotum, and other differences in details of surface sculpture. It occurs from Chiapas (Mexico) to Brazil, in the Congo, and in the Camerouns. Therefore, *javanus* must be restored as a valid name to designate the above species.

Microcorthylus minutus Schedl

Microcorthylus minutus Schedl, 1950, Dusenía 1: 160 (Syntypes, females; Nova Teutonia, Santa Catarina, Brazil; Schedl and Plaumann colls.)

Microcorthylus minutissimus Schedl, 1952, Dusenía 3:361 (Syntypes; Jamaica; Schedl Coll.).
New synonymy

Female syntypes of *minutus* Schedl and *minutissimus* Schedl were compared directly to one another and to 36 other specimens from Veracruz, Honduras, Costa Rica, Panama, and Brazil. Only one small, distinctive species is represented by this material.

Pseudopityophthorus limbatus Eggers

Pseudopityophthorus limbatus Eggers, 1930, Ent. Blätt. 26:169 (Holotype, female; "R. d. M.," Mexico; deposited in Eggers collection, evidently now on loan to Schedl)

Pseudopityophthorus micans Wood, 1967, Great Basin Nat. 27:44 (Holotype, male; 96 km W. Durango, Durango, Mexico; Wood Coll.).
New synonymy

The female holotype of *Pseudopityophthorus limbatus* Eggers and the female allotype of *P. micans* Wood were compared directly to one another and to 85 other specimens of this species and were found to represent only one species.

Xyleborus obliquus (LeConte)

Pityophthorus obliquus LeConte, 1878, in Schwarz. Proc. Amer. Philos. Soc. 17:432 (Holotype, female; Enterprise, Florida; Mus. Comp. Zool.)

Xyleborus gilvipes Blandford, 1898, Biol. Centr. Amer.. Coleopt. 4(6):205 (Holotype, female; Zapote, Guatemala; British Mus.). New synonymy

Xyleborus brasiliensis Eggers, 1928, Arch. Inst. Biol., São Paulo 1:96 (Lectotype, female; Blumenau, Santa Catarina, Brazil; U.S. Nat. Mus.). New synonymy

Xyleborus illepidus Schedl, 1941, Rev. Zool. Bot. Afr. 34:402 (Holotype, female; Deutsch Ostafrika; Schedl Coll.). New synonymy

This species has been reported from areas disturbed by human activities in a pattern that suggests introduction. Its origin has not been established except that allied species are Neotropical. Its occurrence in Africa appears to be recent.

In establishing the above synonymy, the holotypes of *obliquus* (LeConte), *gilvipes* Blandford, and *illepidus* Schedl, the lectotype of *brasiliensis* Eggers, and 78 U.S., 46 Neotropical (Mexico, Guatemala, Colombia, Brazil), and 14 African (Con-

go) specimens were examined and compared directly. There is a certain amount of variability within this material, but the variation between series is no greater than it is within a series.

In addition to the above, the synonymy of this species with *linderæ* (Hopkins) and *mexicanus* Eggers has already been established.

TAXA NEW TO SCIENCE

Dacnophthorus, n. gen.

This genus is distinguished from *Pityophthorus* Eichhoff by the very slender body form, by the very large, coarsely faceted eyes, by the large antennal club, with two partly septate sutures, by the pronotal summit being anterior to the middle of the pronotum and lacking a transverse impression posterior to it, by the distinctive elytral declivity, and by the very different habits.

Frons dimorphic, male convex above, impressed below, female uniformly shallowly concave to lower third, then weakly convex, upper area variously sculptured and ornamented by hair; eye very large, coarsely faceted, emarginate. Antennal scape slender, elongate; funicle 5-segmented, some specimens apparently 4-segmented; club large, much longer than scape, sutures 1 and 2 partly septate, 3 clearly indicated by setae and rather remote from apex. Pronotum elongate, summit anterior to middle, without a transverse impression behind summit. Scutellum rather large, flat. Elytra striate; declivity rather short, steep. Legs as in *Pityophthorus*.

TYPE-SPECIES.— *Gnathophthorus cle-matus* Wood.

NOTE.— The five species previously placed by me in *Gnathophthorus* must be transferred to this genus.

Araptus consobrinus, n. sp.

This species is distinguished from *attenuatus* Wood by the evenly convex elytral declivity (*attenuatus* has striae 1 impressed and interstriae 1 weakly elevated) and, on the female frons, by the coarser, more abundant, longer, yellowish vestiture.

MALE.— Length 1.4 mm (paratypes 1.4-1.7 mm), 2.7 times as long as wide; color very dark brown.

Frons similar to *attenuatus* except more nearly convex, punctures not as coarse, no indications of aciculation, median callus at upper level of eyes smaller, less strongly elevated.

Pronotum as in *attenuatus* except anterior margin armed by about eight serrations.

Elytra as in *attenuatus* except surface less brightly shining, strial punctures slightly larger. Declivity more evenly convex, punctures much smaller; striae 1 not impressed, interstriae 1 not elevated.

FEMALE.— Similar to male except frons much as in female *attenuatus* except frontal hair much more abundant, coarser, slightly longer, yellowish in color.

TYPE LOCALITY.— Six km or 4 miles N Tepic, Nayarit, Mexico.

TYPE MATERIAL.— The male holotype, female allotype, and 20 paratypes were taken at the type locality on 13-VII-1965, 1000 m, No. 241, from a shrub; seven paratypes are from 33 km or 21 miles N Juchitlan, Jalisco, Mexico, 3-VII-1965, 1300 m, No. 177, *Ficus* twigs 3 cm in diameter, all by me.

The holotype, allotype, and paratypes are in my collection.

Araptus micaceus, n. sp.

This species is distinguished from *obsoletus* (Blandford) by the strongly impressed frons, with a pair of epistomal calluses at the anterior articulations of the mandibles, by the smooth surface between punctures on the area above the eyes, and by the coarser strial punctures on the declivity.

MALE.— Length 1.4 mm (paratypes 1.3-1.4 mm), 2.6 times as long as wide; color light brown.

Frons as in *obsoletus* except much more strongly impressed, punctures in impressed area smaller, surface on area above eyes reticulate; epistomal calluses at anterior articulation of mandibles much larger.

Pronotum as in *obsoletus* except serrations on anterior margin much smaller (margin subcostate) and reticulation on posterior areas more strongly impressed.

Elytra as in *obsoletus* except strial punctures much larger, interstriae one and

one-half times as wide as striae on disc, about twice as wide on declivity; impressed points obsolete on declivity.

FEMALE.— Similar to male except frons planoconvex on median two-thirds from level of antennal insertion to slightly above eyes, finely, closely punctured except impunctate on median line to upper level of eyes, punctured area bearing fine, rather long, moderately abundant hair; hair shorter, less abundant and covering a smaller area than in female *obsoletus*.

TYPE LOCALITY.— Los Corchos, Nayarit, Mexico.

TYPE MATERIAL.— The male holotype, female allotype, and seven paratypes were taken at the type locality on 10-VII-1965, 7 m elevation, No. 222, from a recently cut vine, by me.

The holotype, allotype, and paratypes are in my collection.

Pityophthorus costatus, n. sp.

This aberrant species has a variable number of segments in the antennal funicle; it is also distinguished by the long, costiform pronotal asperities, by the stout body form, by the frons, and by other characters.

FEMALE.— Length 1.1 mm (paratypes, 1.1-1.2 mm), 2.3 times as long as wide; color dark reddish brown.

Frons rather strongly convex, an abrupt, moderately deep impression immediately above epistomal margin, epistomal margin distinctly elevated except for small median notch; surface smooth shining, sparsely punctured, punctures rather coarse, area above eyes somewhat reticulate; vestiture very sparse, short. Antennal funicle variable, 3-5-segmented; club ovate, small, sutures almost straight, 1 and 2 septate only at margins.

Pronotum 1.0 times as long as wide; widest at base, weakly arcuate on basal third rather strongly converging toward narrowly rounded anterior margin; anterior margin continuously costate; summit just behind middle, rather indefinite; asperities long, subcostate, confused, continued to basal fourth in median area; posterior areas strongly reticulate, punctures small, not close. Glabrous.

Elytra 1.5 times as long as wide, 1.6 times as long as pronotum; sides almost

straight and parallel on basal two-thirds, rather broadly rounded behind; striae not impressed, punctures small, deep, spaced by one to two diameters of a puncture; interstriae smooth, shining, two to three times as wide as striae, punctures minute, confused, rather close. Declivity steep, convex; striae not impressed, punctures greatly reduced to obsolete; interstriae as on disc except punctures reduced to obsolete. Vestiture confined to declivity, of sparse, short, stout interstitial setae.

MALE.— Similar to female except epistomal impression usually more strongly impressed in lateral areas, with a weak median elevation dividing this impression.

TYPE LOCALITY.— Tapanti, Cartago, Costa Rica.

TYPE MATERIAL.— The female holotype, male allotype, and 12 paratypes were taken at the type locality on 2-VII-1963, 1300 m, No. 11a, from a liana, by me. Two paratypes are from 13 km SE Cartago, Cartago, Costa Rica, 3-VII-1963, 1800, from the same species of liana, by me.

The holotype, allotype, and paratypes are in my collection.

Pityophthorus inceptis, n. sp.

This species is distinguished by the simple male frons and declivity, by the female frontal vestiture and by the coarse pronotal and elytral punctures. It is not closely allied to other known species.

FEMALE.— Length 1.5 mm (male paratypes 1.5-1.6 mm), 2.7 times as long as wide; color very dark brown.

Frons basically convex except flattened on median half from epistoma to slightly above eyes; surface shining, punctures rather coarse, moderately close; vestiture rather sparse and short except on margins of upper half of flattened area forming a dense fringe of long yellow hair, longest setae equal in length to three-fourths distance from their bases to epistomal margin. Antennal club broadly obovate, 1.2 times as long as wide, suture 1 almost straight, 2 moderately procurved.

Pronotum 1.07 times as long as wide; widest on basal third, moderately arcuate from base to rather broadly rounded anterior margin; anterior margin armed by about six to eight low, basally contiguous

teeth; summit at middle; asperities rather coarse, confused; posterior areas subrugose-reticulate, punctures coarse, deep, mostly spaced by distances equal to one-half diameter of a puncture, median line impunctate. Vestiture of sparse semi-recumbent short hair in lateral and asperate areas.

Elytra 1.7 times as long as wide, 1.7 times as long as pronotum; sides almost straight and parallel on basal three-fourths, somewhat narrowly rounded behind; striae not impressed, punctures rather coarse, deep, occasional punctures not in row, spaced by less than diameter of a puncture; interstriae almost smooth, shining, impunctate except for an occasional puncture near declivity. Declivity steep, convex; striae not impressed, punctures reduced, about one-third as large as on disc, distinctly impressed; interstriae as on disc except 1 and 3 each with a row of fine punctures. Vestiture confined to sides and declivity, that on sides of minute striae hair, that on declivity of fine, rather short interstitial setae on odd-numbered interstriae.

MALE.— Similar to female except frons more uniformly convex, without brush of long hair; serrations on anterior margin of pronotum slightly larger.

TYPE LOCALITY.— Six km or four miles W Quiroga, Michoacan, Mexico.

TYPE MATERIAL.— The female holotype, male allotype, and one male paratype were taken at the type locality on 17-VI-1965, 2200 m, No. 72, from a shrub by herbaceous plant, by me.

The holotype, allotype, and paratype are in my collection.

Pityophthorus timidulus, n. sp.

This species is distinguished from *men-dosus* Wood by the larger size, by the coarser pronotal punctures, and by slight differences on the elytral declivity. Both species are allied to *mandibularis* Schedl.

MALE.— Length 2.0 mm (paratypes 1.8-2.0 mm), 2.5 times as long as wide; color very dark brown.

Frons convex above eyes, upper half of area below upper level of eyes rather abruptly, strongly, transversely impressed almost from eye to eye, a smaller trans-

verse impression in lateral areas immediately above epistoma; surface shining, coarsely, rather closely punctured; vestiture sparse except on epistoma. Antennal club oval, 1.3 times as long as wide, sutures 1 and 2 moderately arcuate, 2 at middle of club.

Pronotum 1.1 times as long as wide; sides on basal half almost straight, subparallel, rather broadly rounded in front; anterior margin armed by about 12 low serrations; summit at middle; asperities on anterior slope rather coarse, close, confused; posterior areas smooth, shining, with moderately abundant minute impressed points, punctures rather coarse, deep, moderately close, irregularly spaced by about one to two diameters of a puncture. Glabrous except a few setae on margins.

Elytra 1.6 times as long as wide, 1.6 times as long as pronotum; sides almost straight and parallel on basal two-thirds, rather broadly rounded behind; striae 1 weakly, others not impressed, punctures rather small, deep, spaced by diameter of one puncture; interstriae smooth, shining, a few small punctures on 1 near declivity, others impunctate. Declivity steep, convex, shallowly bisulcate; interstriae 1 distinctly elevated, armed by a row of about seven rounded tubercles, 2 moderately impressed, slightly wider than 1, smooth, shining, devoid of punctures, 3 convex, as high as 1, armed as on 1, lateral areas with punctures somewhat confused. Vestiture confined to declivity, consisting of rather short, moderately coarse, sparse, interstitial setae on odd-numbered interstriae.

FEMALE.— Similar to male except frons below upper level of eyes shallowly, broadly, transversely impressed, surface regular, not granulate, punctures moderately fine, vestiture sparse, declivital sulcus much less strongly impressed, granules on interstriae 1 and 3 minute.

TYPE LOCALITY.— Volcan Chiriqui, Chiriqui, Panama.

TYPE MATERIAL.— The male holotype, female allotype, and 12 paratypes were taken at the type locality on 11-I-1964, 1800 m, No. 407, from a sapling 4 cm in diameter, by me.

The holotype, allotype, and paratypes are in my collection.

Pityophthorus mendosus, n. sp.

This species is distinguished from *timidulus* Wood by the smaller size, by the smaller pronotal punctures, by the shorter, stouter elytral bristles, and by the complete absence of tubercles on female declivital interstriae 1 and 3.

MALE.— Length 1.7 mm (paratypes 1.5-1.7 mm), 2.8 times as long as wide; color very dark brown.

Frons as in *timidulus* except callus at level of antennal insertion usually more strongly developed and with a small cusp at dorsomedian extremity. Pronotal punctures averaging slightly smaller than in *timidulus*. Elytra as in *timidulus* except declivital setae slightly shorter and distinctly stouter.

FEMALE.— As in female *timidulus* except frons less distinctly impressed, declivital granules absent, and declivital setae shorter and stouter.

TYPE LOCALITY.— San Isidro del General, San José, Costa Rica.

TYPE MATERIAL.— The male holotype, female allotype, and 18 paratypes were taken at the type locality on 5-XII-63, 1000 m, No. 282, from "Fósforo" leaf petioles, by me.

The holotype, allotype, and paratypes are in my collection.

Pityophthorus degener, n. sp.

This species is distinguished from the allied *timidulus* Wood and *mendosus* Wood by the much more weakly impressed male frons, by the strongly impressed elytral declivity, and by the finer pronotal punctures.

MALE.— Length 2.0 mm (paratypes 1.7-2.0 mm), 2.8 times as long as wide; color very dark brown.

Frons convex, but with abrupt, irregular, shallow, transverse impressions just below upper level of eyes and just above epistoma; surface subshining, coarsely, closely punctured; almost glabrous except at epistomal margin. Pronotum and elytral disc as in *timidulus* and *mendosus* except pronotal punctures much smaller, slightly closer; elytral declivity strongly bisulcate, interstriae 1 almost as high as wide, 3 higher than 1, each armed by a

row of moderately coarse tubercles. Elytral vestiture as in *timidulus*.

FEMALE.— Similar to male except median half of frons flattened below upper level, surface smooth, with punctures rather fine, close, deep, with rather abundant, fine, moderately long hair; declivital sulcus half as deep, interstriae 1 and 3 unarmed.

TYPE LOCALITY.— Volcan Chiriqui, Chiriqui, Panama.

TYPE MATERIAL.— The male holotype, female allotype, and seven paratypes were taken at the type locality on 11-I-1964, 1800 m, No. 384, from a tree limb 8 cm in diameter, by me.

The holotype, allotype, and paratypes are in my collection.

Pityophthorus amicus, n. sp.

This species is distinguished from *degener* Wood by the absence of sexual dimorphism, and by the different frons, pronotum, and other characters.

MALE.—Length 1.8 mm (paratypes 1.7–1.9 mm), 2.7 times as long as wide; color reddish brown.

Frons convex above eyes, with median line smooth, impunctate, a median callus at upper level of eyes, area below upper level of eyes broadly, shallowly, transversely impressed to epistoma; surface almost smooth, punctures moderately coarse, close, deep; almost glabrous except along epistoma.

Pronotum 1.2 times as long as wide; outline as in *degener*; asperate area continued slightly into lateral portion of posterior half as weak rugae; posterior areas smooth, shining, with rather numerous impressed points, punctures rather fine, moderately close, median line impunctate. Sparse setae confined to asperate area.

Elytra 1.5 times as long as wide, 1.3 times as long as pronotum; outline as in *timidulus* Wood; striae not impressed, punctures rather small, deep, close, rows occasionally slightly confused; interstriae smooth, shining, slightly irregular, with a few impressed lines, impressed points moderately abundant, 1 with obscure subgranulate punctures almost to base, others with an occasional similar puncture. De-

clivity steep, strongly bisulcate, sulcus commencing slightly behind middle of elytral length; striae 1 and 2 with punctures reduced in size but clearly impressed; interstriae 1 almost as high as wide, 3 higher than 1, each armed by a row of about eight subacute tubercles of moderate size, 2 wider than 1, its surface ascending laterally, unarmed. Vestiture consisting of interstitial bristles on declivity, continued to middle of disc on odd-numbered interstriae; longest bristles rather slender, equal in length to twice width of an interstriae.

FEMALE.— Similar to male in all respects.

TYPE LOCALITY.— Guapiles, Limon, Costa Rica.

TYPE MATERIAL.—The male holotype, female allotype, and 12 paratypes were taken at the type locality on 22-VIII-1966, 100 m, No. 121, from a liana, by me. Eighteen paratypes are from Coatzacoalcas, Veracruz, Mexico, 26-VI-1967, 30 m, No. 103, liana, by me.

The holotype, allotype, and paratypes are in my collection.

Pityophthorus dissolutus, n. sp.

This species is distinguished from *explicitus* Wood by the finer frontal punctures, by the finer granules on the pronotal disc, and by the shallower declivital sulcus that is armed by finer granules.

MALE.—Length 1.5 mm (paratypes 1.4–1.6 mm), 2.7 times as long as wide; color dark brown.

Frons convex, a fine median tubercle on epistomal process; surface strongly reticulate, punctures rather fine, deep, spaced by diameter of a puncture or more; vestiture fine, sparse, inconspicuous.

Pronotum 1.1 times as long as wide; widest on basal half, sides feebly arcuate, subparallel, rather narrowly rounded in front; anterior margin armed by about eight moderately coarse serrations; summit at middle, indefinite; asperities rather fine, confused; posterior areas strongly reticulate, punctures rather fine, moderately close. Vestiture confined to marginal and asperate areas.

Elytra 1.6 times as long as wide, 1.5 times as long as pronotum; sides almost

straight and parallel on basal two-thirds, rather broadly rounded behind; striae 1 weakly, others not impressed, punctures fine, distinct, decreasing in size posteriorly; interstriae almost smooth, with some indistinctly impressed lines, about three times as wide as striae on basal fourth, six times as wide near declivity. Declivity rather steep, shallowly bisulcate; striae 1 deeply impressed, punctures small, indistinct, surface ascending gradually to lateral convexity, striae 2 obscure; interstriae 1 almost as high as wide, almost smooth, with a row of fine tubercles, 2 and lateral areas shining, rather densely covered by impressed points, 3 slightly higher than 1, similarly armed. Vestiture of minute strial hair, and, on posterior half, interstitial bristles on odd-numbered interstriae; bristles sparse, rather fine, short.

FEMALE.— Similar to male except epistomal tubercle evidently absent, and declivital impressed points reduced or absent.

TYPE LOCALITY.— Thirteen km SE Cartago, Cartago, Costa Rica.

TYPE MATERIAL.—The male holotype, female allotype, and 27 paratypes were taken on 24-IX-1963, 1800 m, No. 201, from a liana 1 cm in diameter. Two paratypes are from Tapanti, Cartago, Costa Rica, 24-X-63, 1300 m, No. 244, liana; and six paratypes are from Volcan Chiriqui, Chiriqui, Panama, 11-I-1964, No. 394, in a sapling; all were taken by me.

The holotype, allotype, and paratypes are in my collection.

Pityophthorus explicitus, n. sp.

This species is distinguished from *dissolutus* Wood by the coarser frontal punctures, by the larger granules on the pronotal disc, and by the deeper declivital sulcus that is armed by coarser granules.

MALE.— Length 1.5 mm (paratypes 1.5-1.7 mm), 2.7 times as long as wide; color very dark brown.

Frons as in *dissolutus* except punctures distinctly larger, spaced by less than diameter of a puncture. Pronotum as in *dissolutus* except granule on lateral margins of discal punctures distinctly larger. Elytra as in *dissolutus* except declivital sulcus deeper, wider, interstriae 2 not ascending laterally on lower half.

FEMALE.— Female similar to male in all respects.

TYPE LOCALITY.— Nine km NE Teziutlan, Puebla, Mexico.

TYPE MATERIAL.— The male holotype, female allotype, and 14 paratypes were taken at the type locality on 2-VII-1967, 1600 m, No. 143, from a liana, by me.

The holotype, allotype, and paratypes are in my collection.

Xyleborus californicus, n. sp.

This species almost certainly was introduced into California from another area, possibly from South America or southeastern Asia. Among North American species it might be confused with *pubescens* Zimmermann, but it is distinguished by the smaller size, by the more abundant pubescence, and by the reticulate-granulate interiors of the strial punctures on the declivity.

FEMALE.—Length 2.0 mm (paratypes 2.0-2.2 mm), 2.9 times as long as wide; color yellowish brown.

Frons rather strongly convex; surface strongly reticulate, a few small granules from epistoma to upper level of eyes. Vestiture of fine, sparse hair.

Pronotum 1.2 times as long as wide; sides almost straight and parallel on basal two-thirds, rather broadly rounded in front; anterior margin unarmed; summit in front of middle; anterior slope steep, rather coarsely asperate; posterior areas strongly reticulate, punctures small, shallow, rather close. Vestiture of fine, short, rather abundant hair.

Elytra 1.7 times as long as wide, 1.4 times as long as pronotum; sides almost straight and parallel on basal two-thirds, broadly rounded behind; disc occupying basal three-fourths; striae not impressed, punctures small, shallow, distinct, in rows, spaced by diameter of a puncture; interstriae three to four times as wide as striae, almost smooth, shining, punctures fine, in definite rows in some specimens, distinctly confused on basal half in others. Declivity steep, convex, general contours as in *pubescens*; strial punctures large, shallow, distinct, their interior surfaces reticulate-granulate; interstriae only slightly wider than striae, their punctures mostly replaced by minute granules on

all interstriae, a few larger granules on 1, 3, and lateral areas; posterolateral margin rounded, with an indefinite row of scattered granules. Vestiture of rather abundant, short, fine hair, distinctly longer on margins of declivity.

TYPE LOCALITY.—Stanford University, Palo Alto, California.

TYPE MATERIAL.—The female holotype and five female paratypes were taken at the type locality on 15-25-III-1944, by C. D. Duncan. One paratype is from Knight's Landing, Yolo Co., California, 10-I-1949, at light, by J. R. Fowler.

The holotype is in the California Academy of Sciences; three paratypes are in the Canadian National Collection, two are in my collection, and one is in the U.S. National Museum.

Specimens of this species were sent to Bright, Browne, and Schedl in an effort to associate it with a named species from another area, but without success. All agree that its anatomical characters, its current distribution, and the limited period it has been known in California strongly suggest that it was introduced from another area.

Xyleborus incultus, n. sp.

This species is distinguished from *pristis* Wood by the larger size, by the more distinctly impressed stria punctures, and by the declivital sculpture as described below.

FEMALE.—Length 2.3 mm, 2.6 times as long as wide; color dark brown.

Frons and pronotum essentially as in *micarius* Wood except anterior margin of pronotum weakly produced at median line and armed by two larger serrations, punctures on posterior areas larger, at least twice as large as in *micarius*.

Elytra 1.5 times as long as wide, 1.3 times as long as pronotum; sides almost straight and parallel on basal 60 percent, narrowly rounded behind, a slight emargination at suture; striae not impressed, punctures small, distinctly impressed, spaced within a row by one to two diameters of a puncture; interstriae almost smooth, punctures fine, less than half as large as those of striae, moderately confused on basal third of disc, uniseriate behind. Declivity rather steep, convex; sur-

face minutely granular on lower two-thirds, dull; interstriae 1 moderately elevated to near apex, armed by 15 or more small, pointed, confused denticles, 2 rather strongly impressed, armed on upper third by 4-6 similar, uniseriate denticles, 3 slightly elevated, armed as in 1 except denticles almost uniseriate, 4-9 each with a row of fine denticles, 3 and 9 join and continue submarginally to apex as a moderately strong elevation, its crest armed by a row of about four denticles. Vestiture largely confined to sides and declivity; of fine, short stria and slightly longer interstitial hair, longest setae about equal in length to width of an interstriae.

TYPE LOCALITY.—Fort Clayton, Canal Zone, Panama.

TYPE MATERIAL.—The female holotype was taken at the type locality on 22-XII-1963, from a *Cecropia* branch, by me.

The holotype is in my collection.

Xyleborus molestulus, n. sp.

This species is distinguished from *crinitulus* Wood by the interstitial granules on the disc, by the uniseriate rows of elytral setae, and by other characters.

FEMALE.—Length 2.0 mm (paratypes 2.0-2.2 mm), 2.2 times as long as wide; color dark brown.

Frons as in *crinitulus* except less strongly reticulate, more sparsely punctured. Pronotum about as in *crinitulus* except anterior margin armed by eight serrations, posterior areas very finely, shallowly punctured.

Elytra 1.2 times as long as wide, 1.3 times as long as pronotum; sides almost straight and parallel on basal two-thirds, broadly rounded behind; striae not impressed, punctures rather small, shallow, distinct, spaced by one to two diameters of a puncture; interstriae almost smooth, three times as wide as striae, each with a uniseriate row of fine tubercles from base to apex. Declivity occupying posterior half of elytral length, moderately steep, broadly convex; sculpture as on disc except striae 1 feebly impressed; posterolateral margin acutely, subcrenulate elevated from apex to interstriae 7. Vestiture of interstitial rows of long, erect hair from base to apex, alternate setae in each row twice as long as distance be-

tween rows and alternating with setae half that length on both disc and declivity.

TYPE LOCALITY.—Barro Colorado Island, Canal Zone, Panama.

TYPE MATERIAL.—The holotype and six paratypes were taken at the type locality on 27-XII-1963, No. 348, from a tree branch. Four paratypes are from Fort Clayton, Canal Zone, Panama, 22-XII-1963, No. 363, from a tree branch; three paratypes are from Madden Forest, Canal Zone, Panama, 2-I-1964, 70 m, No. 365, from a tree seedling; and one paratype is from 13 km (8 miles) S El Hato del Volcan, Chiriqui, Panama, 7-I-64, tree seedling. All were taken by me.

The holotype and paratypes are in my collection.

Xyleborus tristiculus, n. sp.

This species is distinguished from *molestulus* Wood by the more slender body, by the larger pronotal punctures, and by the differences on the elytra described below.

FEMALE.—Length 2.0 mm (paratypes 1.9-2.1 mm), 2.4 times as long as wide; color brown.

Frons about as in *molestulus* except uniformly, more strongly reticulate.

Pronotum 1.02 times as long as wide; as in *molestulus* except median part of anterior margin weakly produced, four median serrations distinctly larger, and

punctures on posterior areas distinctly larger, spaced by at least two to six diameters of a puncture; vestiture finer, longer, more abundant.

Elytra 1.3 times as long as wide, 1.3 times as long as pronotum; similar to *molestulus* in outline except more narrowly rounded behind; about as in *molestulus* except discal interstriae not as smooth, interstitial punctures very feebly if at all granulate, declivital striae slightly smaller, interstriae not as smooth, interstitial tubercles more closely spaced, averaging smaller. Vestiture consisting of rather long, fine, semirecumbent striae hair on disc and declivity, and rows of erect interstitial setae on declivity and posterior half of disc, each seta coarser and distinctly longer than those of striae, distance between rows and between setae within a row about two-thirds length of a seta.

TYPE LOCALITY.—Brazil, 12° 49' S 51° 46' W (not 12° 31' S as given on label).

TYPE MATERIAL.—The female holotype and four female paratypes were taken at the type locality 8-XI-1968, No. C-47, 22-XI-1968, No. D-35, 24-IX-1968, Nos. 170, 172, 2-XII-1968, No. E-18, all by R. A. Beaver.

The holotype is in the British Museum (Natural History), one paratype is in Museo de Zoologia, Universidade de São Paulo, and three paratypes are in my collection.

CORRELATES OF BURROW LOCATION IN BEECHEY GROUND SQUIRRELS

Donald H. Owings¹ and Mark Borchert¹

ABSTRACT.— Partial correlation analysis indicates that Beechey ground squirrels show a strong preference for digging burrows under and around large objects, may show a weaker tendency to locate their burrows under the cover of tree canopies, and avoid digging burrows in areas with both tree-canopy and ground cover (stones, logs). These relationships hold for large but not small burrow systems. The need for unobstructed visual surveillance and an autumn food supply are proposed to be determinants of these preferences.

Beechey ground squirrels (*Spermophilus beecheyi*) appear to show preferences for areas with certain characteristics for the location of their burrows. At least three factors have been suggested to affect the choice of burrow sites: (1) burrows are often constructed under large objects such as stones or logs (Linsdale 1946: 9); (2) good drainage is said to be important, which is best provided by sloping terrain (Tomich 1962); (3) burrows often seem to be concentrated under the cover of tree canopies (Fitch 1948). One purpose of the research reported here was to quantitatively assess the relationship between burrow location and these three independent variables—ground cover (stones, logs), slope of terrain, and tree canopy cover. In addition, we felt that the effect of ground and tree cover might interact, or at least be additive, in areas in which these factors physically overlapped. We therefore added a fourth independent variable (common cover) to the analysis which consisted of a measure of the amount of area having ground and tree cover in common.

It is probably true, though, that burrow systems of different sizes may differ in their relationship with these variables. Small systems, for instance, may be established by young squirrels who have moved into less than optimal habitat during dispersal, or by adults for refuge from predators when feeding in the open (Fitch 1948; Carl 1971). A second purpose of this research was to divide the burrow systems into size categories for separate analysis.

Study Area

This study was done in the Department of Zoology Experimental Wildlife Area

on the campus of the University of California at Davis (elevation about 15.85 m; 38° 32' N, 121° 47' W). The study plot was located in the 82-m wide original bed of Putah Creek which is now permanently dry. This area contained numerous trees (principally black walnut, *Juglans hindsii*, and valley oak, *Quercus lobata*), grasses (principally ripgut brome, *Bromus rigidus*, with some Italian ryegrass, *Lolium multiflorum*, and wild oats, *Avena fatua*), and thistle (*Centaurea solstitialis* and *Silybum marianum*), as well as logs, and included most of both sloping sides of this cross-section of the bed. A substantial population of squirrels inhabited this area; 44 were trapped and marked in 0.60 ha in the spring of 1973. This area was being mapped in preparation for behavioral studies.

Methods

Our procedure was to lay out a grid of 9.14 x 9.14 m squares and to map on graph paper the location of all burrow entrances, the location and size (to scale) of ground cover, and the outer limits of tree canopies for each of 50 of these squares. We derived measures of ground cover area, tree canopy area, common area, and number of burrow entrances from these maps. Slope was measured over uniform sections of the area; new measures were taken wherever significant changes in slope occurred.

We assumed that size of burrow system was positively correlated with numbers of entrances. We used a portable blower (Steco Model DS-5) and non-toxic smoke bombs (Superior 0.5 min) to assess the number of entrances in a system by blowing smoke into one en-

¹Department of Psychology, University of California, Davis, California 95616.